An Overview of the NOAA Hydrometeorology Testbed Soil Moisture Observing Program

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NOAA Hydrometeorology Testbed Soil Moisture Observations

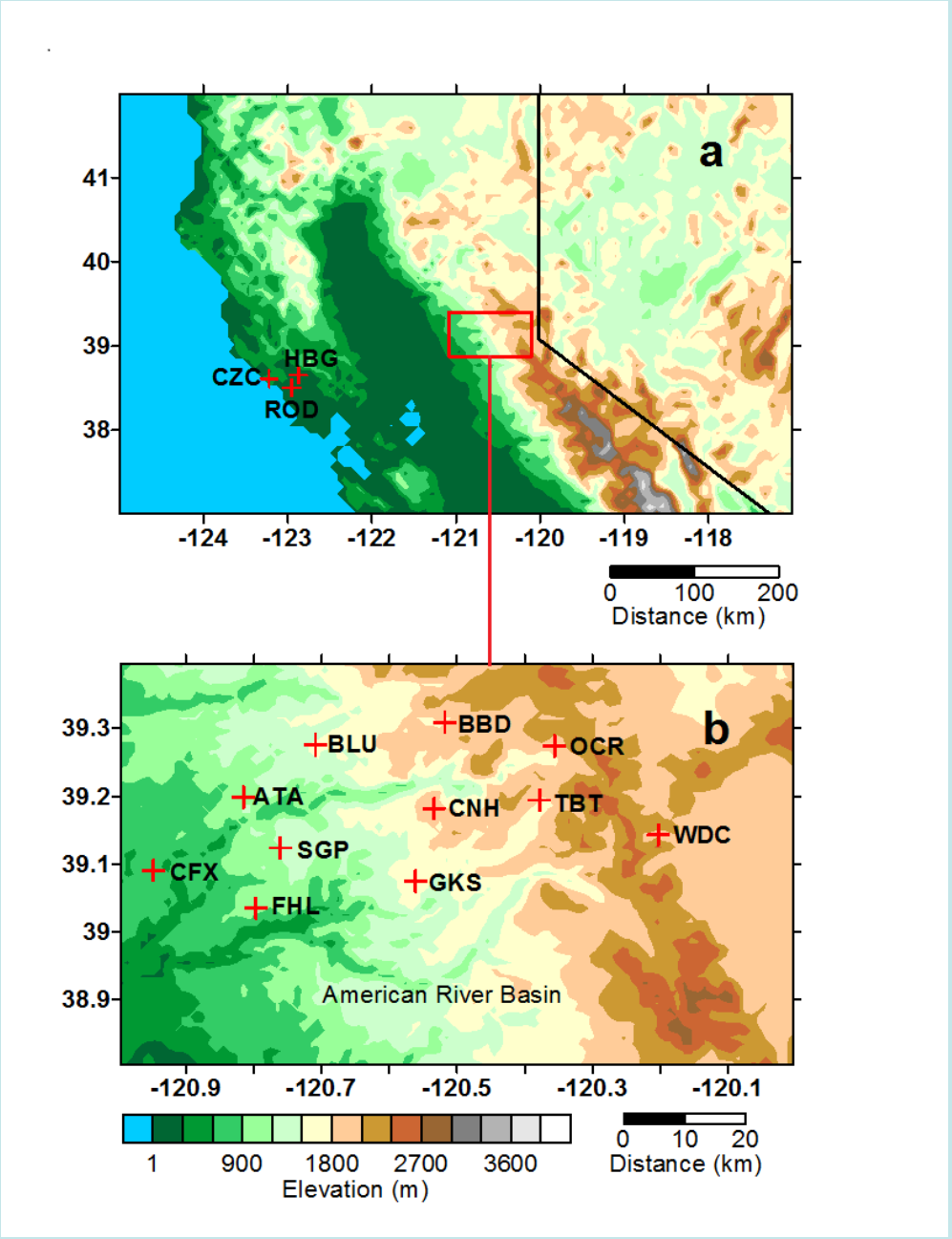
- Transfer of new observing methods, scientific findings, and decision making tools into NWS operations.
- Russian, NF American, Babocamari, and Upper Colorado River Basins.

HMT-West

- 9 NF American River Basin
- 1 Yuba River Basin
- 1 Tahoe
- 3 Russian River Basin

- 2 New HMT Legacy Stations
  Hopland, CA
  Hodgdon Meadow, CA
- 27 Stations by 2013

Partners:
California Department of Water Resources
Scripps Oceanographic Institute



Standard Soil Moisture Station Instrumentation

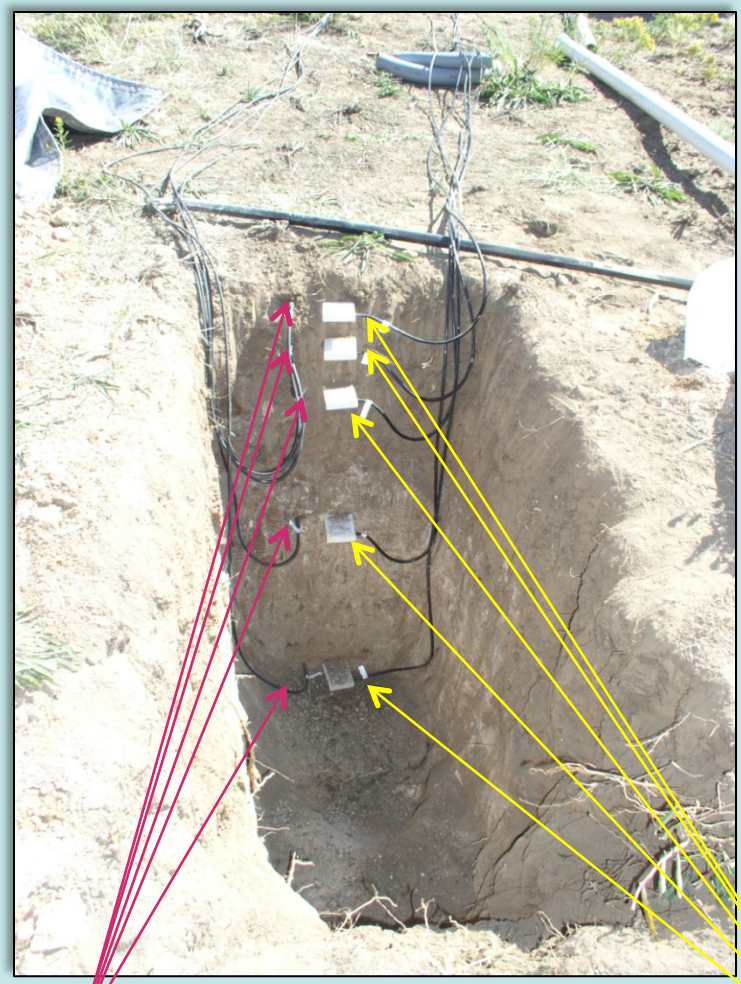
- Campbell Scientific 616 Water Content Reflectometer (Flint USGS)
- Stevens Water Hydra Probe (SCAN, USCRN)
- Campbell Scientific 107 Temperature Probe
- 2.0 m Air Temperature and Relative Humidity
- Tipping Bucket, Heated Tipping Bucket, Weighing Rain Gauges

1.0, 2.0 or 5.0 minute averages transmitted every hour by land line or GOES

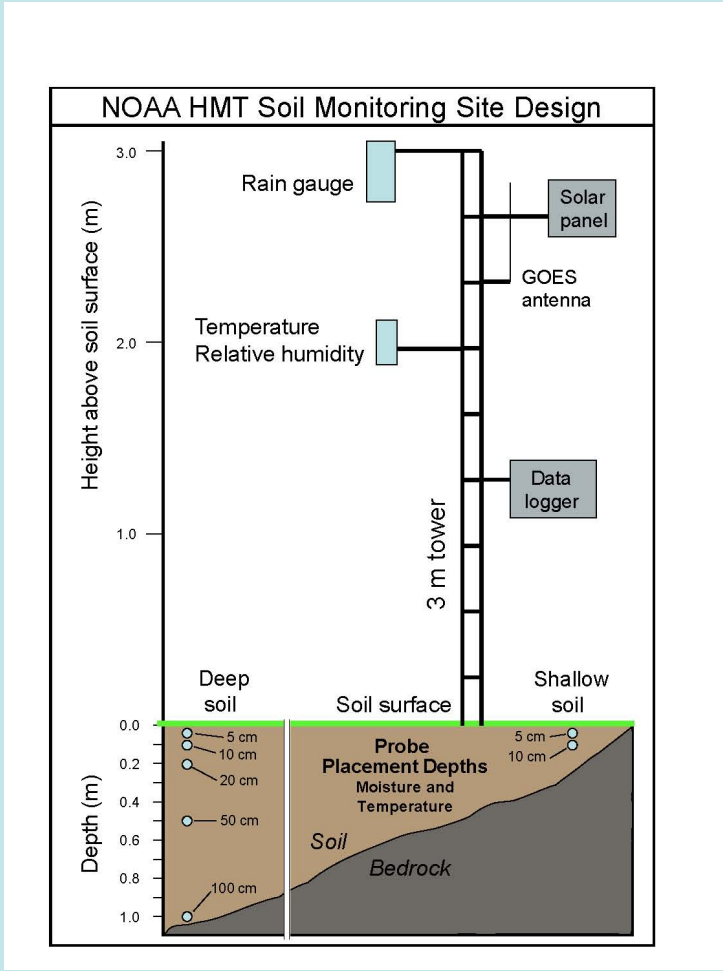
Data archived at ESRL Boulder, CO

http://www.esrl.noaa.gov/psd/programs/soilmoisture/

http://www.esrl.noaa.gov/psd/data/obs/



Soil Temperature Probes



Water Content Reflectometers

Nomenclature

Soil Wetness Fraction

$\theta = V_w/V_t$ (m^3/m^3)

Volumetric Water Content = θ x 100

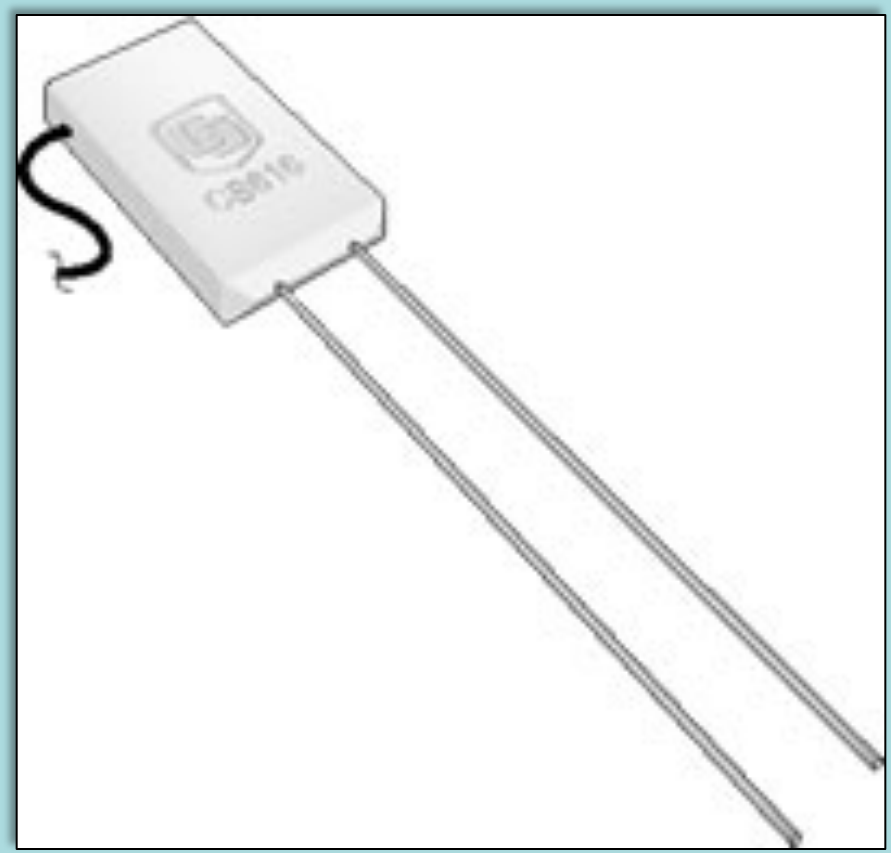
Field Capacity

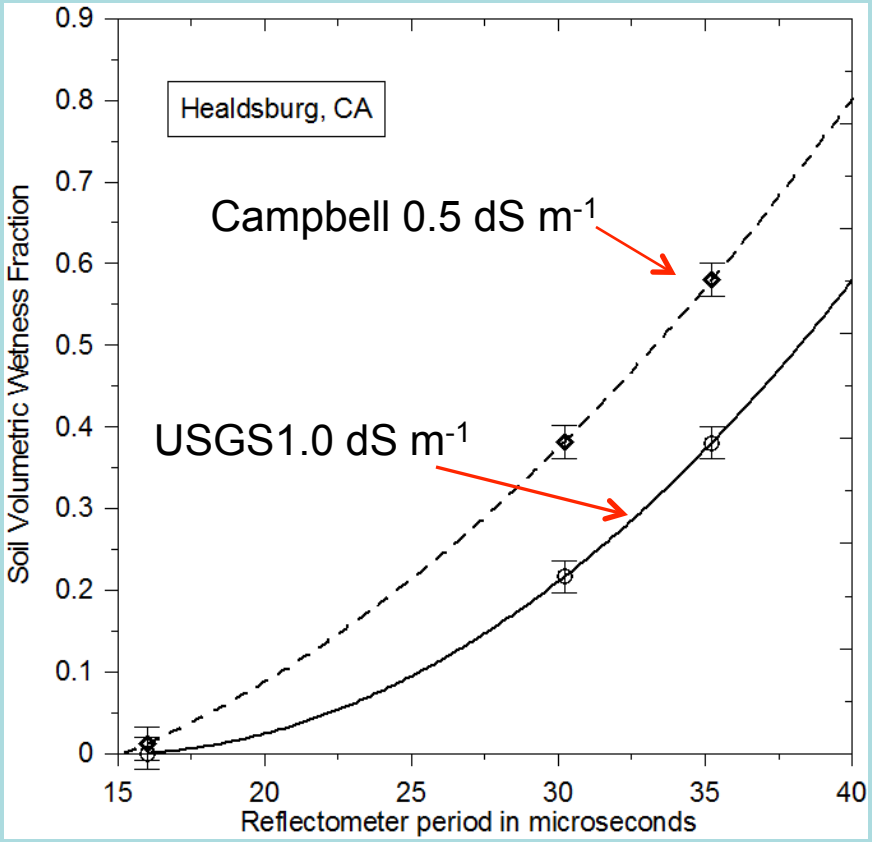
"The amount of water held in the soil after excess water has drained away and the downward movement has materially decreased, which usually takes place within 2-3 days after a rain or irrigation in pervious soils of uniform structure and texture." Veihmeyer and Hendrickson (1952)

Values of $\theta > 0.4$ "usually" indicate saturated soil and/or standing water.

Matric potential sensors cannot handle this condition. TDR and FDR sensors can and do.

Reflectometery and Calibration





- Reflectometer measurements are influenced by soil salinity (electrical conductivity)
- Gravimetric calibration required under certain soil conditions
- Temperature corrections are also applied

Drainage Characteristics of the NF American River Basin

- Role of geology and soil formation
- Precipitation distribution

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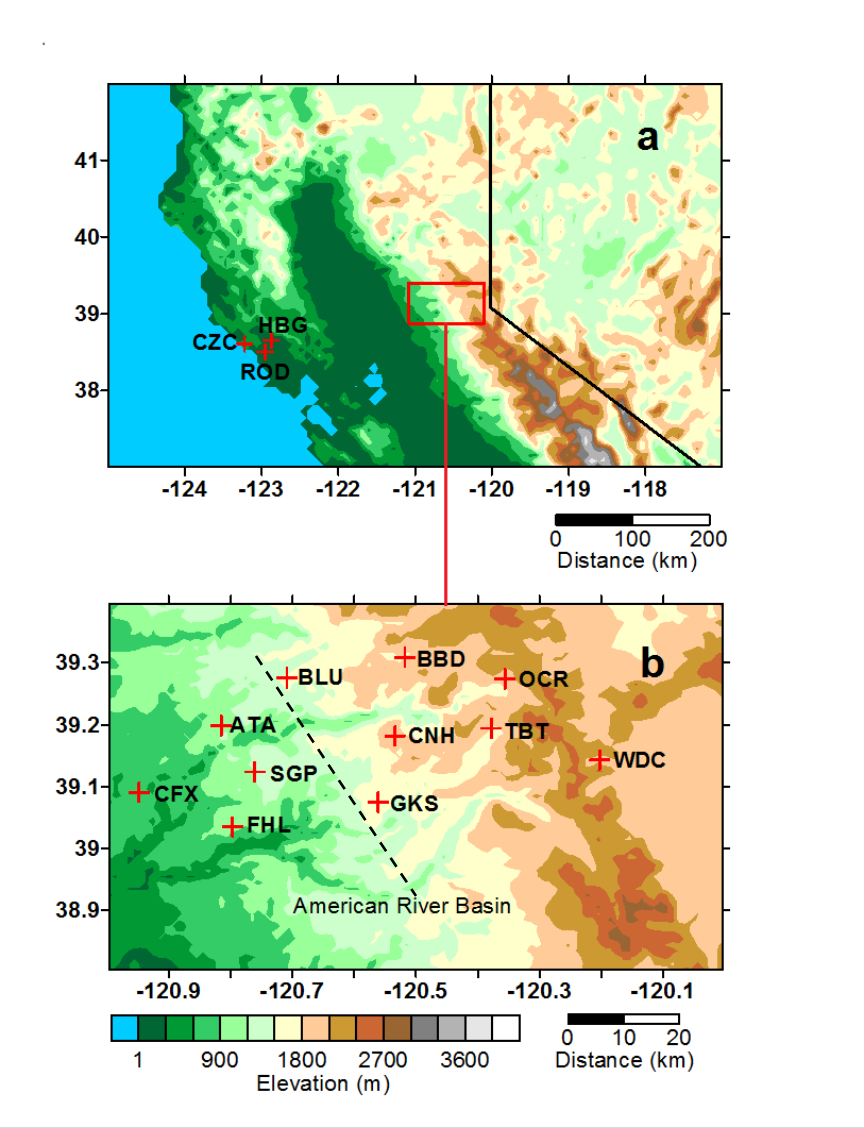
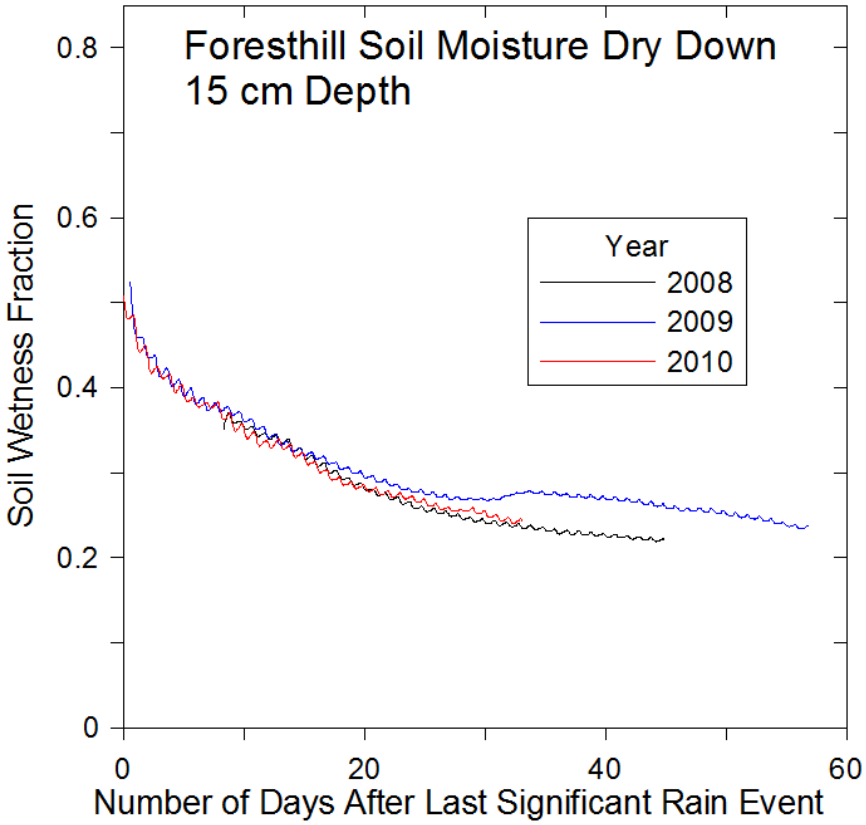
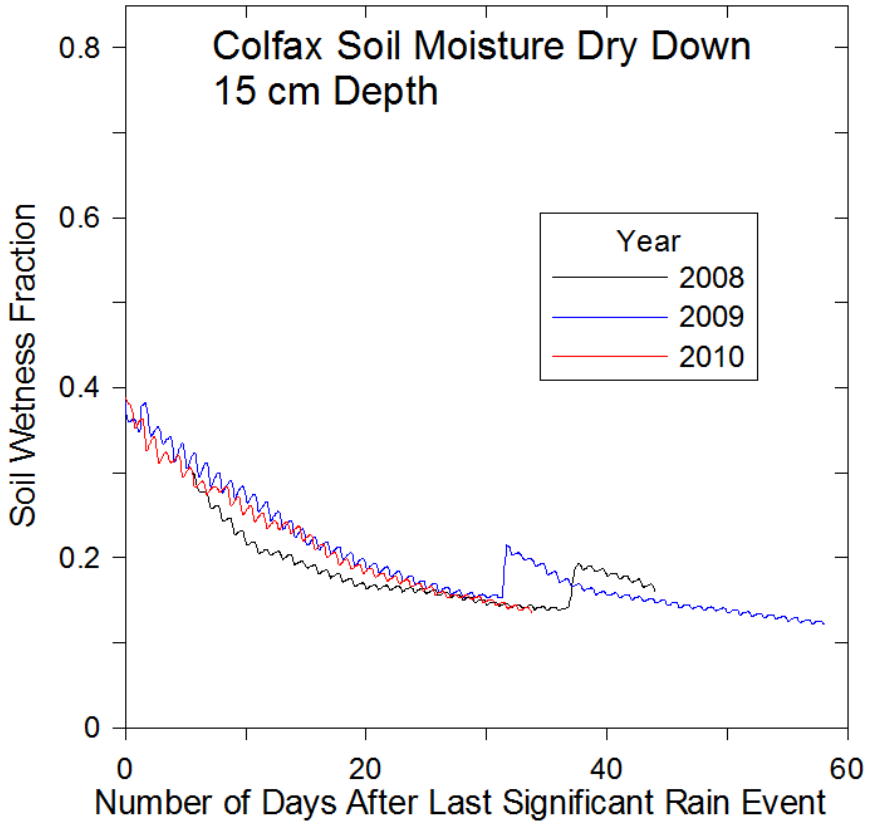


Soil Classifications

Site	Elevation	Soil Type	Percent Clay
Colfax	725 m	gravelly silt loam weathered from tilted slate and schist	27.5%
Foresthill	1048 m	clay loam	23.5%-45%
Blue Canyon	1611 m	gravelly sandy loam from material weathered from andesitic mudflows	10%
Greek Store	1728 m	fine loam from material weathered from volcanic rock	20%-30%
Onion Creek	1886 m	glacial outwash/alluvium from granitic rocks	14%
Canada Hill	2020 m	very gravelly medial course sandy loam	11.5%


Foresthill Soil Moisture Dry Down
15 cm Depth
Soil Wetness Fraction
0.8
0.6
0.4
0.2
0
0
20
40
60
Number of Days After Last Significant Rain Event
Year
2008
2009
2010


Colfax Soil Moisture Dry Down
15 cm Depth
Soil Wetness Fraction
0.8
0.6
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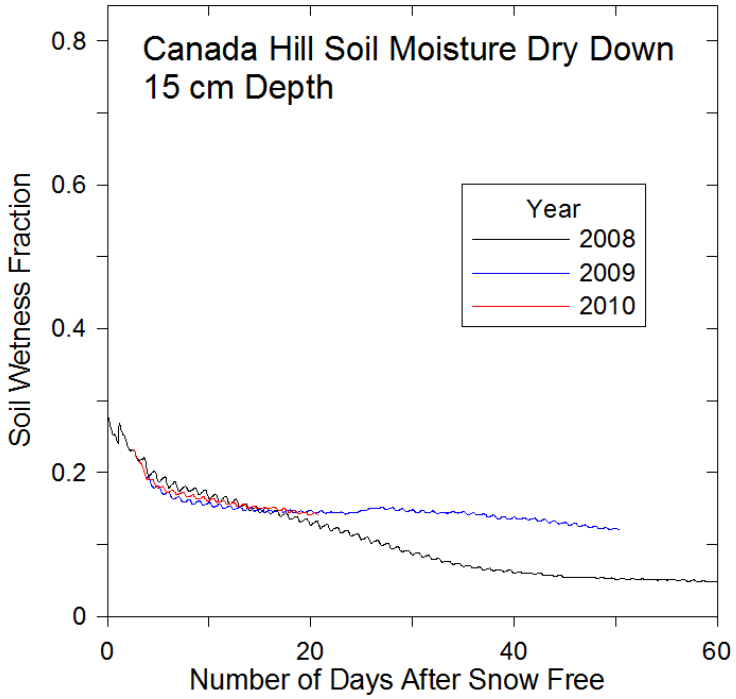
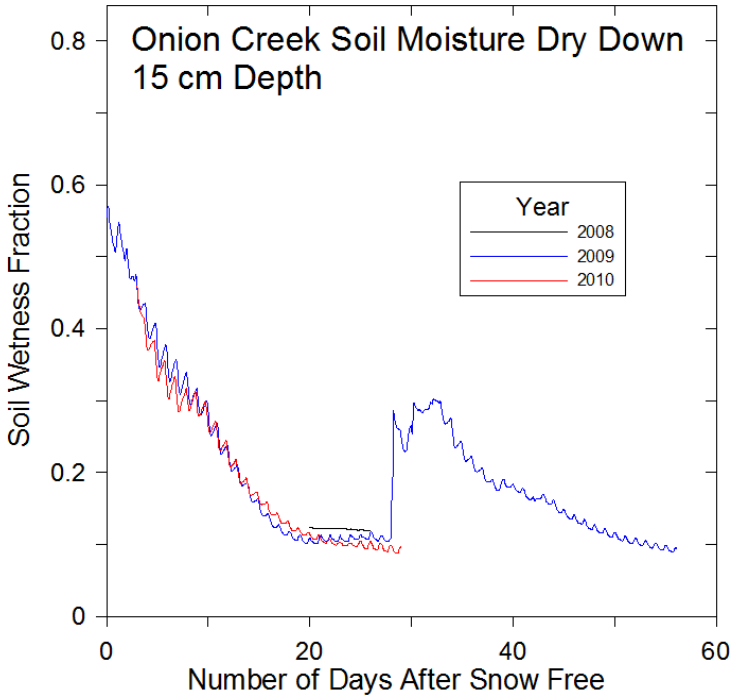
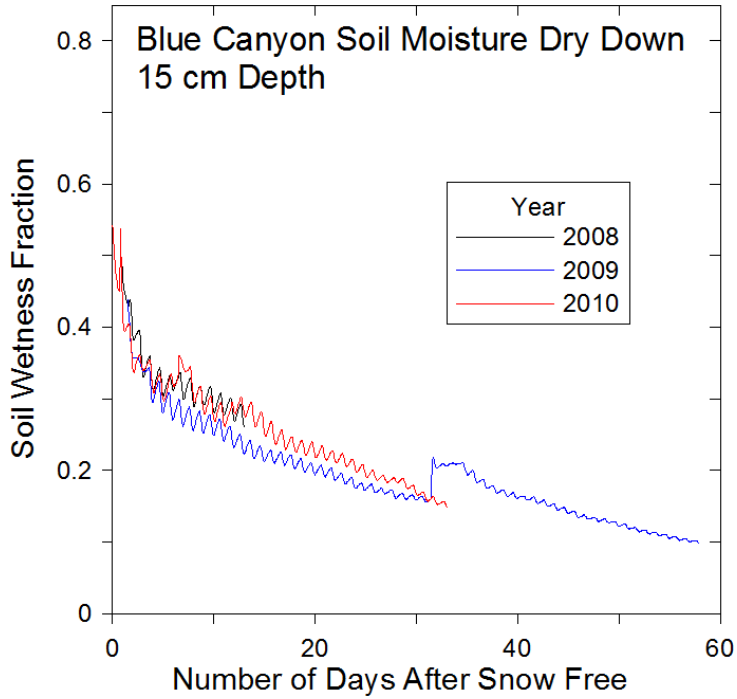
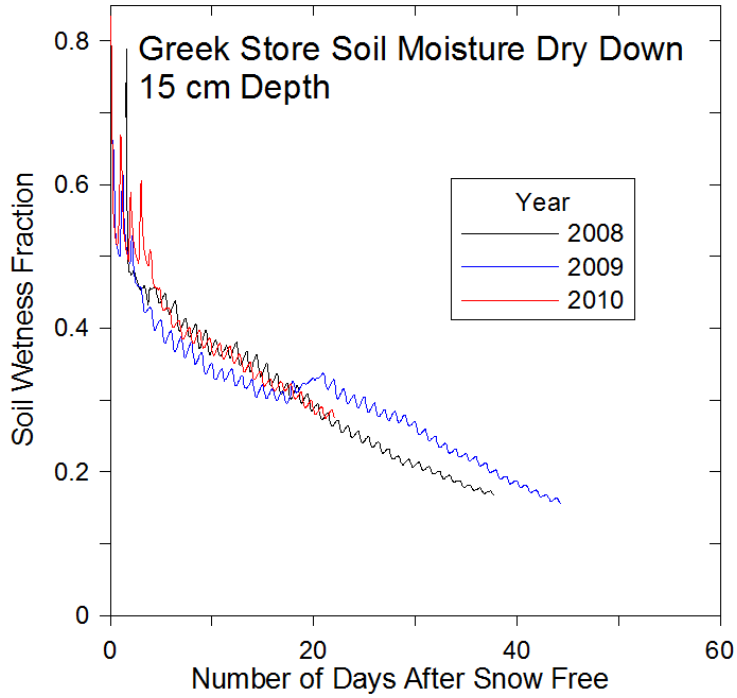

Canada Hill Soil Moisture Dry Down
15 cm Depth
Soil Wetness Fraction
Number of Days After Snow Free
Year
2008
2009
2010
0
0.2
0.4
0.6
0.8
0
20
40
60


Onion Creek Soil Moisture Dry Down
15 cm Depth
Soil Wetness Fraction
Number of Days After Snow Free
Year
2008
2009
2010
0
0.2
0.4
0.6
0.8
0
20
40
60


Blue Canyon Soil Moisture Dry Down
15 cm Depth
Soil Wetness Fraction
Number of Days After Snow Free
Year
2008
2009
2010
0
0.2
0.4
0.6
0.8
0
20
40
60


Greek Store Soil Moisture Dry Down
15 cm Depth
Soil Wetness Fraction
Number of Days After Snow Free
Year
2008
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0
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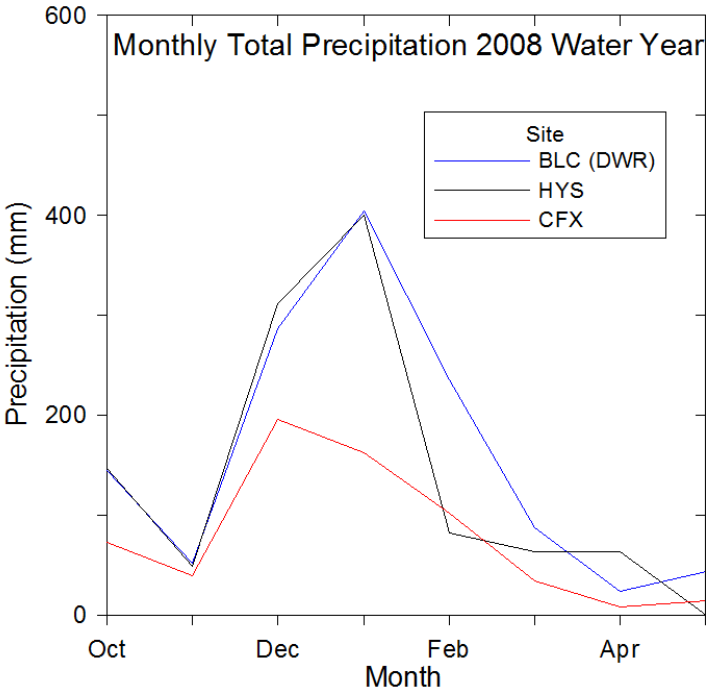
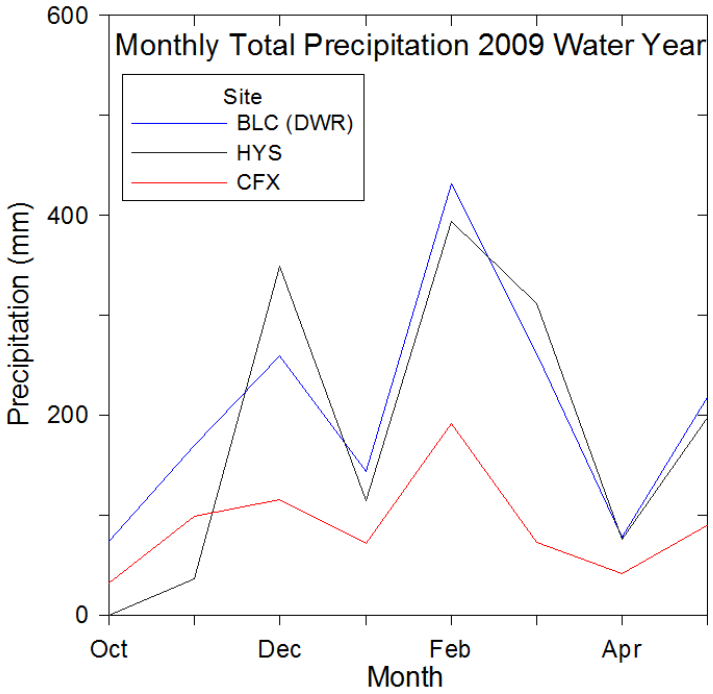
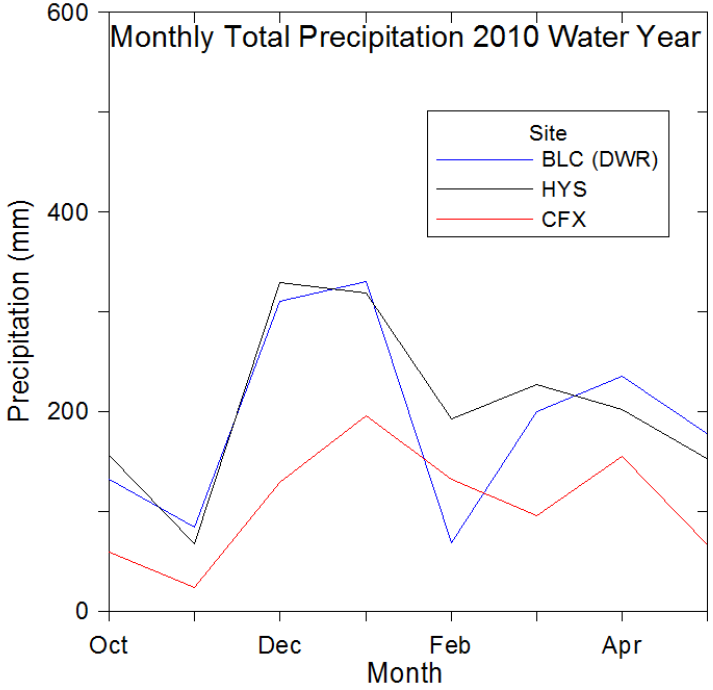
20
40
60

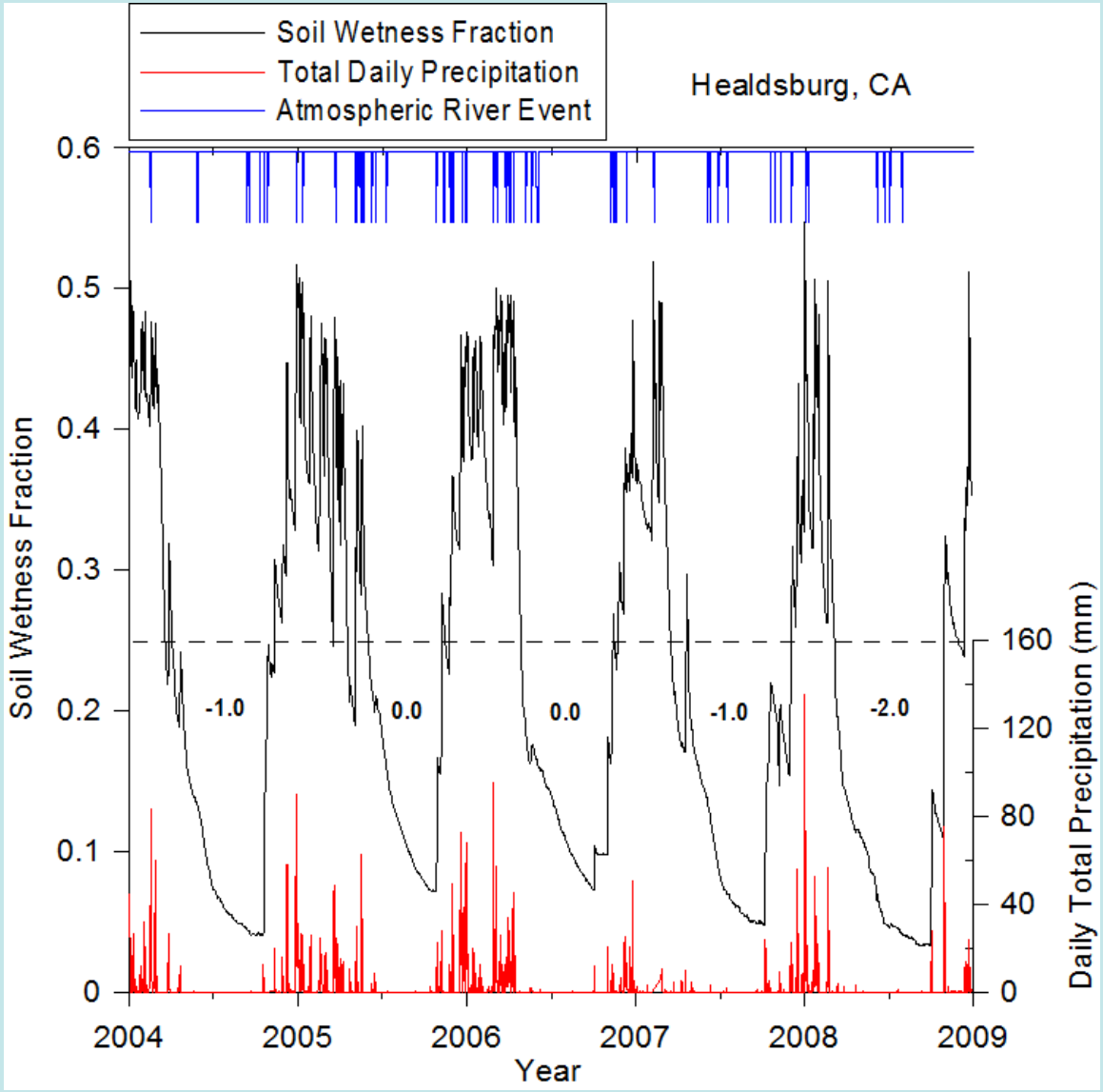
- **General stratification of precipitation:**
  - More in upper basin
  - Less in the lower basin
  - Note max is actually at "soil transition site"
  - Climate Implications







Response of Soil to Atmospheric River Events



Accomplishments

- Arizona sites have been assigned NWS Handbook 5 ID's. Data is being ingested into the Colorado River Basin Forecast Center
- HMT soil moisture data sets are being archived at NCDC (Drought Portal)
- Zamora, R. J., F. M. Ralph., E. Clark, and T. Schneider, 2010: The NOAA Hydrometeorology Testbed Soil Moisture Observing Networks: Design, Instrumentation and Preliminary Results. *J. Atmos. Ocean. Technol.* Accepted for publication